ANALYSIS OF ESSENTIAL OIL CONTENT OBTAINED FROM PLANT MATERIALS USING STEAM DISTILLATION

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
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IN

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UNDER THE GUIDANCE OF

PROF. A. SAHOO

BY

ASHIS PALAI

111CH0081

Department of Chemical Engineering

National Institute of Technology

Rourkela-769008

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National Institute of Technology

Rourkela

CERTIFICATE

This is to certify that the thesis entitled, **"ANALYSYS OF ESSENTIAL OIL CONTENT OBTAINED FROM PLANT MATERIALS USING STEAM DISTILLATION**" submitted by **ASHIS PALAI** in partial fulfilments for the requirements for the award of Bachelor of Technology Degree in Chemical Engineering at **National Institute of Technology**, **Rourkela** is an authentic work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other University / Institute for the award of any Degree or Diploma.

Date:

Rourkela

Prof. (Mrs.) A. Sahoo
Dept. of Chemical Engineering,
National Institute of Technology,
Rourkela - 769008, Orissa

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Rourkela

Date:

ASHIS PALAI

Roll No- 111CH0081

Dept. of Chemical Engineering,

National Institute of Technology,Rourkela

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ABSTRACT

An expansive number of materials contain Essential Oils with broad bioactvities. Recognizing the significance of plant and its restorative quality, Essential Oil was extracted utilizing Steam Distillation technique. In this venture Steam Distillation was utilized to concentrate oil from distinctive plant materials like eucalyptus leaf, curry leaf, hibiscus leaf, marigold blossoms, rose blooms, orange peels and so forth. Examination has affirmed hundreds of years of down to earth utilization of vital oils, and we now realize that the 'fragrant drug store' contain mixes with an amazingly expansive scope of biochemical effects. Fundamental oils are accepted to speak to the very substance of odour and flavour. The recuperation of Essential Oil from the crude organic beginning material is essential since the nature of the oil is enormously impacted amid this step. There is a mixed bag of strategies for acquiring unstable oil from plant. Steam distillation technique was discovered for systems of the extraction of key oil from plants as legitimate distiller will protect the first characteristics of the plant. The distillation was led in Clevenger apparatus where bubbling, gathering and decantation was finished. Examination of Essential oil had been done utilizing Gas Chromatography-Mass Spectrometer, which gives evaluates Essential Oil subjectively and quantetatively. Volume of Oil acquired had been changed with respect to temperature and heating.

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CHAPTER 1

INTRODUCTION

1.Introducton:

Essential oil contains exceedingly volatile materials which disengaged by a physical technique or methodology from plant of a solitary organic animal categories. The oil typically carry the name of the plants , where they are determined. oil is accepted to speak to the very sense of odour and flavour. Essential oil plants incorporate an expansive scope of plants that are utilized for aromatic esteem as flavourings in nourishments and drinks and as scents in pharmaceuticals and mechanical items. Essential oils get from plant of numerous generas conveyed around the world.

Oils are utilized as a part of the treating methodology, in prescription and in decontamination customs. There are additionally more than 100 referrences to aromatic, insense testaments. Examination has affirmed hundreds of years of handy utilization of Essential Oils, and we now realize that the 'fragrant drug store' contains mixes with an amazingly wide scope of biochemicals impacts. There are around two hundred fundamental oils all in all utilization today by expert professionals. Persistent assault of bacterial, viral, parasitic and contagious defilement happens in our body. Fundamental oils are an awesome advantage to help shield our body and homes from this surge of pathogen. Safe framework need bolster and these fundamental oil will produce the obliged underwriting [1].

2. Scope And Objective:

- The aim of our project is to extract oils from plants such as : curry, lavender, rosemary, mint, lemon peels and leaves by steam distillation method. There are also some flowers such as jasmine, lavender ,roseetc from which we can extract essential oils.

- Essential oils have an economical value, marketing value and industrial value in both local and international markets.

- Essential oils are aromatic substances widely used in the Perfume industry, Food and Flavouring, Cosmetics, and Pharmaceutical Products.

- They have high value in economic since they enter a wide range of industry.

CHAPTER 2

LITERATURE REVIEW

It is assessed that there is 350k to 400k types of plant. A generally little rate (2 to 8%) of these is utilized as substenances by people and other creature species. It is conceivable that significantly more are utilized for medicinal purposes stated that however 520 types of plants have been utilized by different Americans assembles as nourishment, 3,464 have discovered use as medications. As per his estimations, this leaves give or take 17,000 types of plants which were utilized for nether sustenance nor drug [4].

Plant oil and excerpts has utilized for a varied assortment of drives for some hundred of year. These reasons fluctuate from the utilization of roswoods and cidar wood in perffumery, to enhancing beverages with, fenel, lime or juneper berries oil, and the use of lemon oil for the conservation of put away nourishment crop. Specifically, the anti microbial action of plants oil and sources has shaped the premise of numerous application, with crude and prepared sustenance safeguarding, pharmaceuticals, option prescription and characteristic treatments

2.1 Definition:

Essential oils are concerted, hydrophobe liquids which is unstable fragrance mixes from plant. Essential oils are otherwise called unstable, etherneal oil or just as the "oils of" the plants which they were separated, for example, oil of cloves. Oil is "essentials" as in it conveys a particular fragrance, or pith, plants [5].

Essential oil is often alluded to as the "life forces " of plant. These "vital" is extricated from blossoms, leave, stem, root, seed, barks, and natural product skins. The measure of key oil can be collected from anywhere in the range of 0.001 percentage to 9 percentage of the aggregate.oil has powerful antimicrobial components, containg extensive variety of helpful contents. This type of oil is frequently utilized for their flavour and restorative property, in a large determination of items, for example, nourishments, medication, and beatufiers. Just unadulterated oils contain a full range of intensifies that shabby impersonations basically can't copied [5].

Table-2.1: Different materials used for extraction of oil:

Leaf	Flower	Peels	Seed	Woods
Basel	Chamomile	Bergammot	Almmond	Cammphor
Bayleaves	Clary Sage	Grapefruits	Annise	Cedares
Cinamon	Cloves	Lemmon	Celeries	Rose woods
Eucalypotus	Gerannium	Limes	Cummin	Sandal woods
LemonGrasses	Hyssop	Orange	Nutmeg Oil	
Melaleuca	Jasmmines	Tanggerine		
Oreganno	Lavennder			
Patchouli	Manuka			
Pepermint	Marjoram			
Pines	Orange			
Rose maries	Roses			
Spearmint	Ylanng-Ylanng			
TeaTrees				
Wintergreen				
Thymme				
Berry	**Bark**	**Resins**	**Rhizzome**	**Roots**
Alspice	Casia	Frankinncense	Ginngers	Valerrian
Junniper	Cinamon	Myrh		

2.2 Chemical Constituents Of Extracted Oil:

An Essential Oils contain 250 chemicals constituents , however few are commonly unpredictable. Essential oil comprise of substance mixes which have, oxygen carbon and hydrogen as their buildings squares [1]. It is basically characterized in two gatherings:

2.2.1 Volatility part: Essential oil containing 85–90% of the oils by weight, consisting themonoterpene and sesquitterpene hydrocarbons and ester .

2.2.2 Nonvolatileresidue : This contains 1.0–10.0% of the oils contain hydro carbons, fatty acids,wax,flavonnoids.

Case in point, the constituents of the oil separated commencing flora varies as per where these plants rooted [6]. These contents are divided into two gatherings, for example, hydro carbon comprised of for the most part terpennes which is oxygenate mixes this is basically aldehyde, ketone ,alcohol, ester, , phenol. A percentage of normal constituent is recorded underneath alongside their properties.

2.2.3 Lactones:

Lactone is created by intermolecular esterification of hydrocarboxylic acid, this is taken placed continuously at the ring which are created in four- or fieve-numbered. Lacton with four-or five-numbered rings (α-lactonne and β-lactonne) are vquite active, constructing these isomoration not easy.These are basically needed for laboratory amalgamation for decrese-rings lacttones and large numbered carbon members.

2.2.4 Ketones:

Ketone which is seemed in plant are utilized for respiratory objections. It helps the stream for bodily fluid as well as straightforwardness clogging .oils consisting ketones are gainful to advancing injury mending, empowering the arrangement of scattered tissues. Ketone is exceptionally poisonous. The largely lethal ketones are Thujjone colected at muggwort, sagge, tannsy, thuja , wood oils.lethal ketone collected in key oil are puleggone of penyroyal, pinocammphone in hysops. Few un-poisonous ketone are in jasmmine oils.

2.2.5 Acids:

For the most part organics acid is collected in little amounts into its free phase inside Essentials Oil. Plants acid go about like segments or else support frameworks controls acid factor.This additionally demonstration hostile to provocative. Illustrations are cinamic, bennzoic acids of bennzoin, lacticacid.

2.2.6 Alcohols:

2.2.6.1 Monoterpene alcohols:

This oil has better antiseptics, antiviral and antifungal property with little effect like skins problem and toxic or has an inspiring refreshing effects. Example of this alcohol is mainly linalol, citronelol, terppineol etc.collected from lavenders, roses,geraniums, within junipers and teatrees oils.

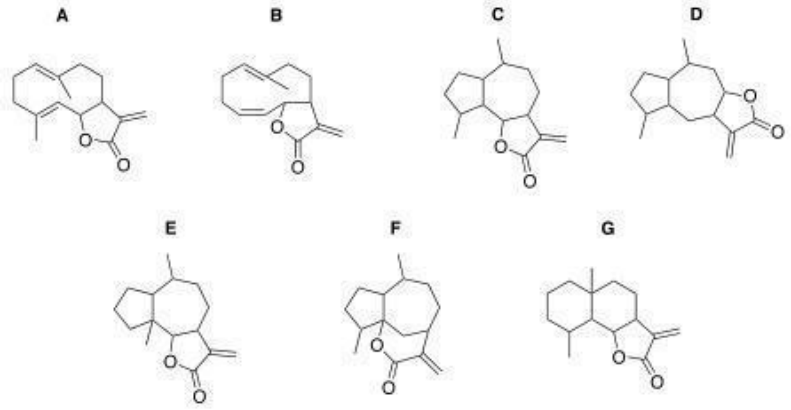
2.2.6.2 Sesquiterpene alcohols:

This type alcohol isn't generally originate with in essentials oil,when found, like bisabollol at Germany chamomil, has more uses, inwhich includes liver and glandullar stimulants, antiallergen and antiinflammatory. Other oil that contain sesquiterpene alcohols.

2.2.7 Diterpenes:

Isoprene has been a necessary part in the vast majority of the segments are there in 4 iso prene unit in Diterppenes. with Steam Distillation methods we can't identify Diterppenes like these atoms are so substantial it couldn't be possible consider vanishing, so it can be found in distilled Essential Oil. Diterppenes happens every plant familie and contain mixture of C_{20} chains. Around 2400 recognized Diterppenes that fit in 25 noteworthy basic sort.. In a comparable way to monoterppenes,Diterppenes appear as of digestion system for geranylpyrophosphate . Restoratively Diterpenes have constrained significance and are utilized as a part of specific narcotics (hacks) and in addition in antispasmodics and anxiolytics.

2.2.8 Sesquiterpene Lactones:



A: Germaccranolides **B**:Helianngolides **C**,**D**: Guainolides

E: Pseudogaianolides **F**: Hypocrtenolides **G**: Eudesnanolides

Fig2.1: Structure of different components in Sesquitterpene

2.2.9 Terpenes:

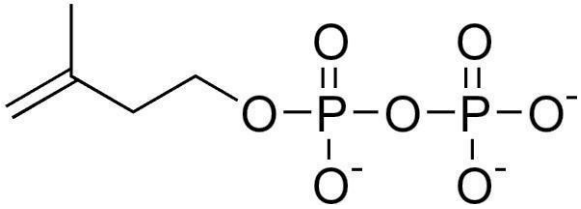


Fig2.2: Structure of Terpenes

These parts by and large has name finishing by "enes ".Most are limonenes, pinenes, piperenes, camphenes and so on. This segment go about one antibacteria l, anti viral ,anti-provocative, clean, antivirals and bactericials. This is auxiliary ordered intomonnoterpene, sesquitterpene and diterpene. At the point where 2 of theisoprenes unit is attached tail and head, so outcome is monotterpene, where 3 are gone along with, its sesquiterppene also correspondingly 4 connected isoprenes units are diterppenes.

2.2.10 Hydrocarbons:

Buildings of block for Essentials Oils are hydrogens , carbons.Basic Hydrocarbons collected in plant are isoprenes having accompanying structures.

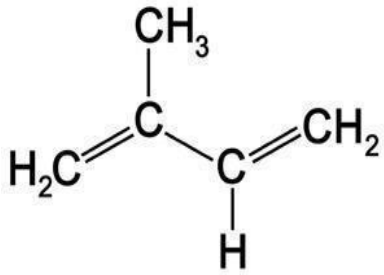


Fig2.3 Structure of hydrocarbon

2.3 Benefits Of Essential Oil:

Essential oils are helpful, speedy and simple to utilize. You can wear them amid the day, diffuse them in your home or work spot, or essentially keep them in your pocket. Essential oils can be utilized as a part of back rub, and to upgrade reflection and focus.

Essential oils are natural substances from the unpredictable fluid of plants. The vital oils bolster the body to return into offset without hurtful symptoms or substance based items. Anyway, verify that you utilize restorative evaluation vital oils, not fragrance review that contain destructive chemicals.

Essential oils advantages incorporate that they can promptly enter the skin and cell films. They can really diffuse all through the blood and tissues immediately in a matter of seconds! Oils cross the cerebrum blood boundary and achieve the amygdala and other limbic parts of the mind that control our temperament, feelings and convictions. So they can help us with our capacity to handle stretch, outrage or some other feeling we are managing.

2.3.1 Importance of Essential Oil in pharmaceutics: A percentage of the applications are recorded underneath.

2.3.2 Germicides: The sterile property for these Oils build dynamic aligned with extensive variety for microscopic organisms upon anti-infection safe strain. Notwithstanding these are additionally beside parasites or yeast.Mostly well-known wellsprings of this oil utilized as antiseptic may be: Cinamon, Thymes, Clovers, Eucalypatus, Lavenders. Cittral, geranniol, linalol and thymols are a great deal extra intense compare to phenols [11].

2.3.3 Expectorant or diuretic : where utilized remotely, this oil like L'esencede terebennthine expand micro circulation or give few neighbourhood sedative activity. By this time, Essentials oil is utilized as part for various salves, creams and gel, where by it is recognized as extremely successful for calming sprain agonies. verbal organization for vital oil of eucalypotus or pine oil, invigorate ciliate epithelials cell for discharging bodily fluid. Up on framework, this is identified to build vasodilations in result realize a diuretics impact.

Essential oil advantages incorporate that they are high in antioxidants. We realize that antioxidants fortify the body's frameworks to keep the harming impacts of maturing, eating regimen, and nature; and wipe out free radicals. The Oxygen Radical Absorbance Capacity (ORAC) which lets you know the cell reinforcement limit of a nourishment thing is archived for some vital oils. Clove key oil has an ORAC estimation of 1,078,700 µTE/100g; this is a million more than the worth for carrots which is 210 µTE/10.

2.4. Types Of Extraction:

Following methods are used to extract Essential oils

2.4.1 Maceration:

Maceration really makes a greater amount of "infused oil" as opposed to vital Oils. Plants matters are absorbed vegetable soils, warmed or stressed and soon thereafter this might have utilized to back rub. These systems are unalluring in light of the fact that this varies arrangement for oils.

2.4.2 Cold Pressing:

These systems are utilized for collecting the oil from orange peels, for example, oranges, lemons, grapefruits and bergamots.These systems include basic squeezing for skin around 115 degree for collect the oils. These peels are differentiated to organic product, is grounded and hacked or squeezed. Then outcomes are mixtures of Essentials oils , fluids which shall separated respective time. small modification to states happens – this citric oil hold its splendid, crisp, up lifting smells like that of noticing a sublimely ready organic product.

2.4.3 Super Critical CO2 Extraction:

Supercriticals CO_2 extraction includes CO_2 warmed to 78 degree Ferrenhite below this condition; CO_2 is compared to heavy vapour .Alongwith arrival for weight in either transform, the carbon dioxide escapes in its vaporous structure, abandoning the Essential Oil. The standard system for extraction is through steam refining. After extraction, the properties of a decent quality fundamental oil ought to be as close as could reasonably be expected to the "embodiment" of the first plant. The way to a "decent" vital oil is through low weight and low temperature transforming. High temperatures, fast transforming and the utilization of solvents modify the sub-atomic structure, will devastate the helpful esteem and change the aroma[10].

2.4.4 Extraction of Essential Oils Using Steam distillation Method:

Steam distillation is a special kind of distillation or a separation process for temperature touchy materials like oils, gums, hydrocarbons, and so forth which are insoluble in water and may deteriorate at their breaking point. The fundamental nature of steam distillation is that it enables a compound or mixture of mixes to be refined at a temperature substantially underneath that of the boiling point(s) of the individual constituent(s). Essential oils contain substances with breaking points up to 200°C or higher temperatures. In the vicinity of steam or bubbling water, then again, these substances are volatilized at a temperature near to 100°C, at atmospheric weight. New, or in some cases dried, botanical material is placed in the plant chamber of the still and the steam is allows to pass through the herb material under weight which mellows the cells and allows the Essential Oil to escape in vapor form. The temperature of the steam must be sufficiently high to vaporize the oil present, yet not all that high that it wrecks the plants or smolders the Essential Oils. Other than the steam small beads of Essential Oil evaporates and travel through a tube into the still's condensation chamber. Here Essential Oil vaporsgather with the steam. The essential oil forms a film on the surface of the water.

CHAPTER 3

EXPERIMENTAL WORKS

3.1. Experimental Setups:

This trial is directed in a Clevenger Apparatus. Contraption comprise of one round bottom flask of 1L and this is joined to other 2 path round bottom flask this holds crude materials. At upper carafe is joined to condensers by connector. Differentiating channel is utilized for division of Essentiasl oils and water.

3.2 Procedures: New materials are cut into pieces under 3 X 3 cm inside a large portion for 200-250 gm overflowed to 450 ml of refined water to apparatus mechanical assembly till oils refining stopped for 2-3 hr. Amount of vital oil is dead set from an adjusted traps.Crucial oil into distillates dried out in anhydrous Na_2SO_4 .

Figure3.1: Cleavengers Apparatus

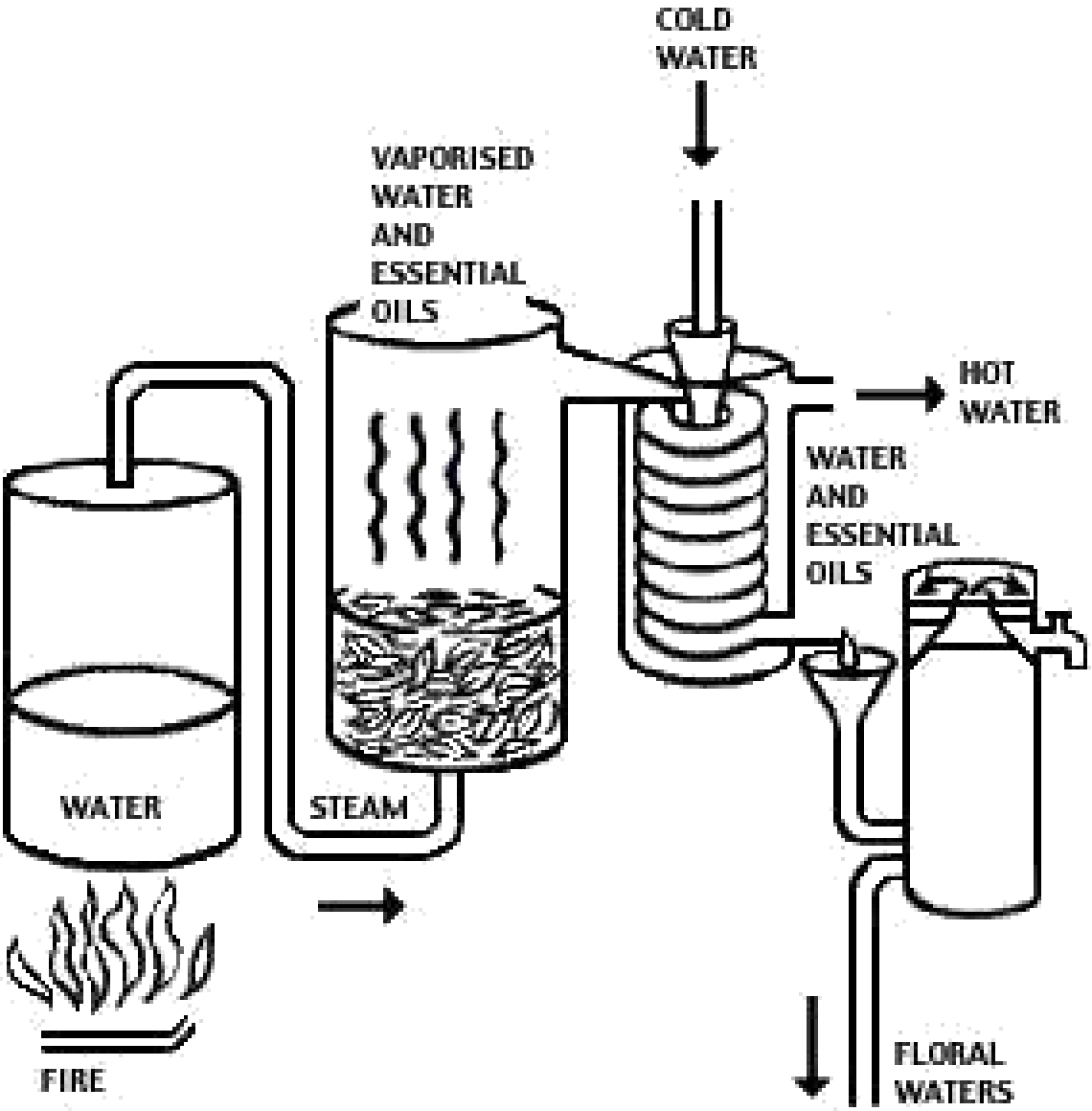


Fig3.2:diagram of the steam distillation process

3.3 Testing of Essential Oil:

Fig3.3 :Gas Chrommatography-Mass Spectrometer:

Gas Chromattography-Mass Spectrometr (GC-MS) is a technique that consolidates the highlights of gas- liquid chromatography and mass spectrometr to distinguish diverse substance inside test samples. Application of GC_MS incorporate medication recognition, fires examination, natural investigations, explosive examination, and ID of obscure specimens. Also, it can distinguish follow components material those were beforehand contains crumbled past ID[6].

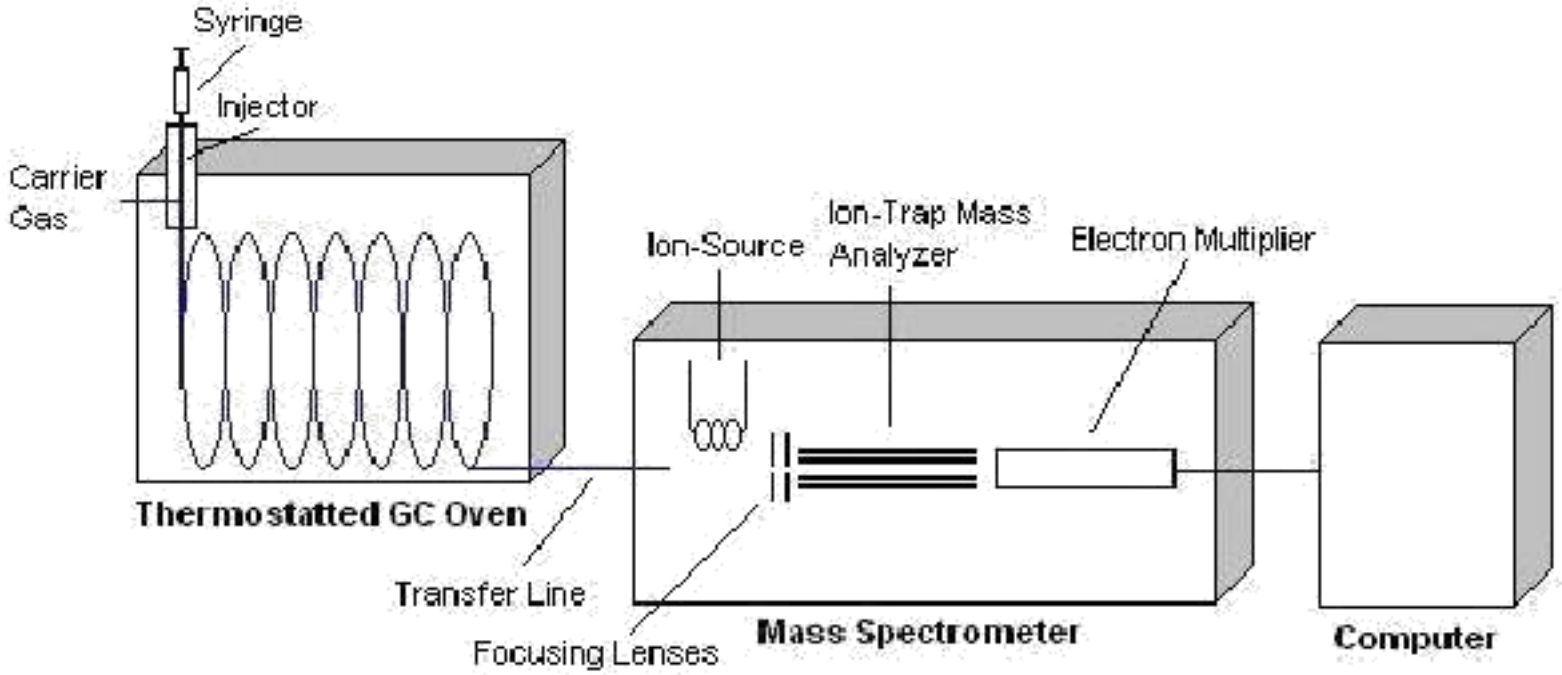


Fig3.4 :Gas Chromatography-Mass spectrometer schematic diagram:

3.5 Observation:

Table 3.1: Volume of oil extracted from different plants.

No.	material	Weight (gm.)	Volumes of water (ml)	Time for heating (min)	Temp (^{0}C)	Volumes of Oils (ml)
1	Orange peel	250	750	180	100	0.6
2	Hibiscus	200	750	120	100	0.5
3	Rose	150	750	120	100	0.4
4	Marigold	200	750	180	100	0.5
5	Curry leaves	150	750	180	100	0.5

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Characterization of extracted oils:

Essential oil is analysed in GC-MS with respective temperature programming and the resulting graphs is being showed below.

4.1.1 GC-MS analysis for curry leaves oil:

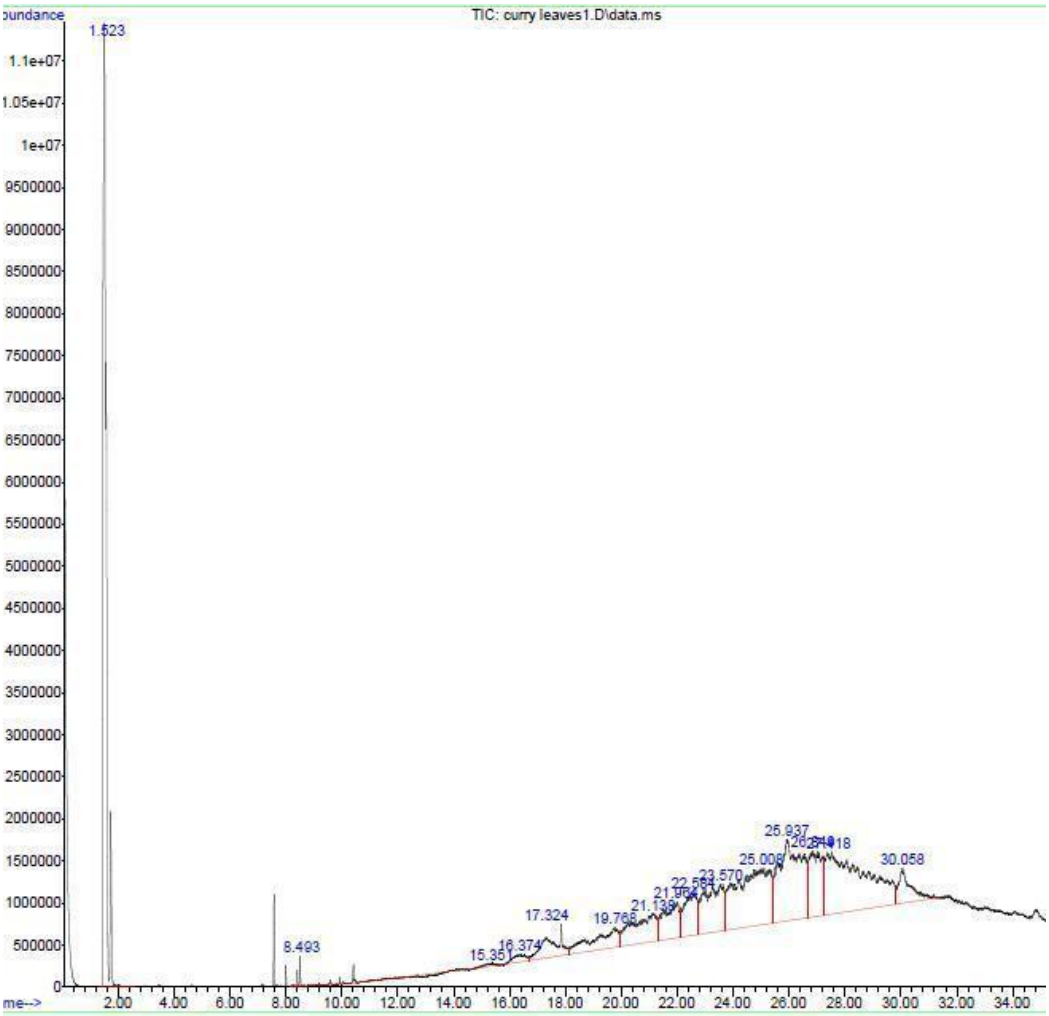


fig4.1:figure showing analysis of curry leaf oil.

4.1.1.1 from the analysis we got the components in curry leaves Oils as:

(a) alpha.-selinene $$ EUDESMA-3,11

(b) choleste-5-en-3-ol (3beta.)- carbonnochloridate

(c) Cyclopropa[7,8]cholestan-3-one,

(d) 22.alpha.-Hydroxy-3,4-secostict-

4.1.2 GC-MS analysis for hibiscus leaves oil:

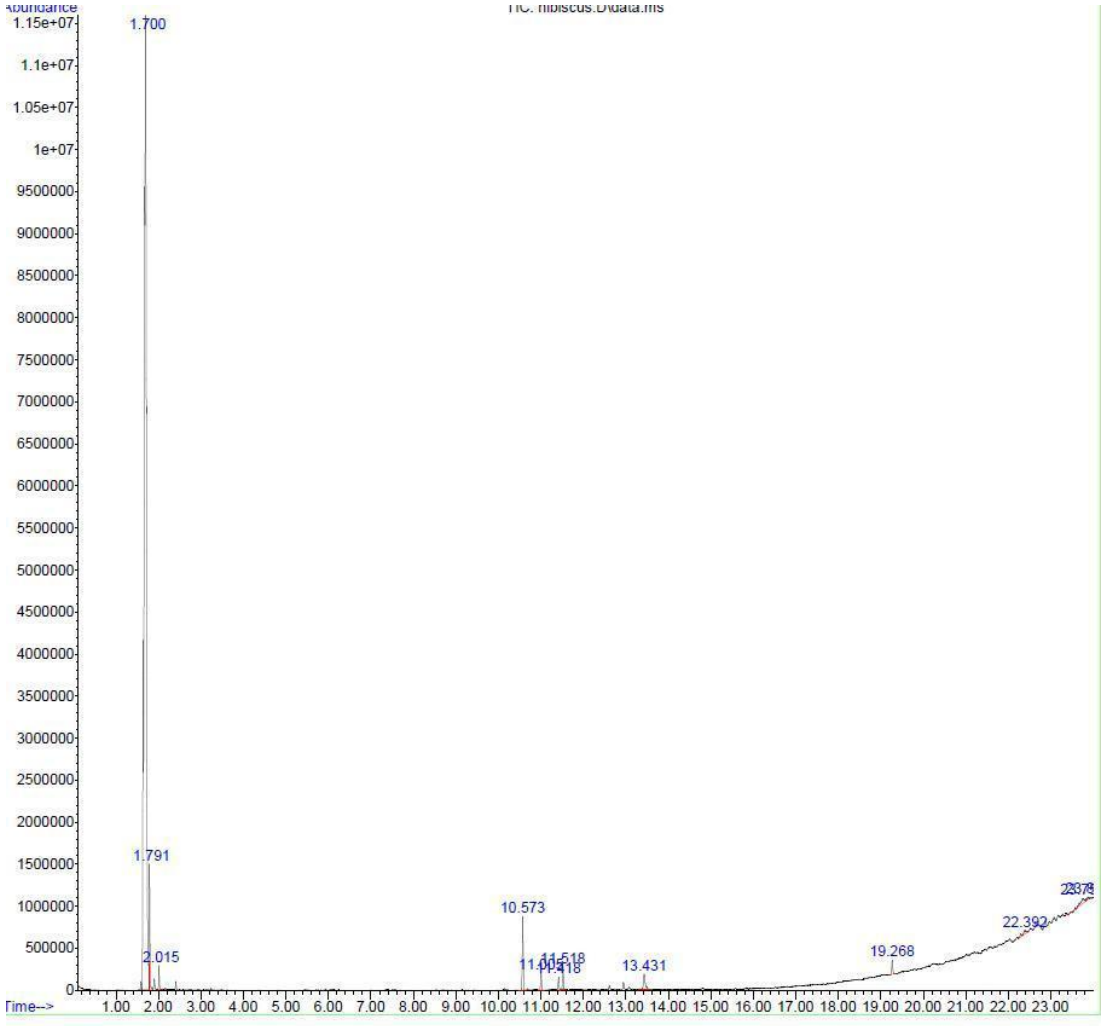


Fig4.2: figure showing analysis of hibiscus leaf oil.

4.1.2.1 from the analysis we got the components in hibiscus leaves Oils as:

(a) Pentane, 3-methy

(b) 1-piperazine carboxamide n n-diethyl

(c) Caryophyllene

(d) alpha.-Humulene

4.1.3 GC-MS analysis for marigold oil:

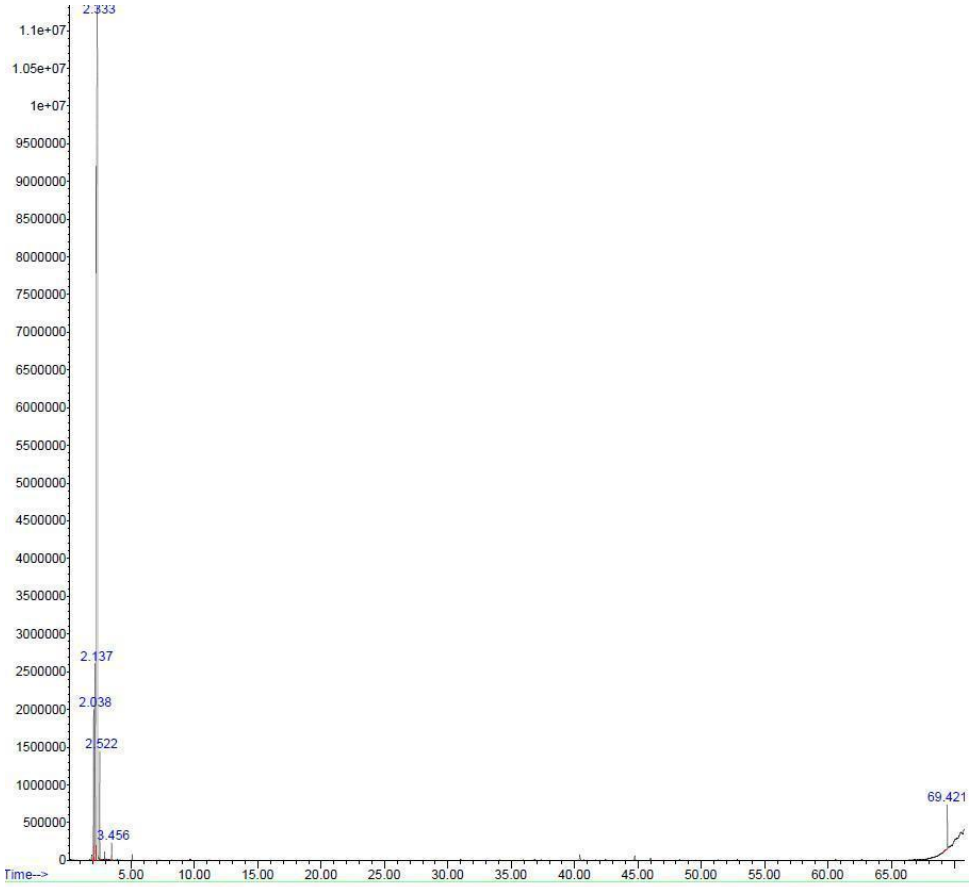


Fig4.3: figure showing analysis of marigold oil.

4.1.3.1 from the analysis we got the components in marigold Oils as:

a) Pentene, 2-methyl

b) Pentane, 3-Methyl

c) Heptane

4.1.4 GC-MS analysis for orange peel oil:

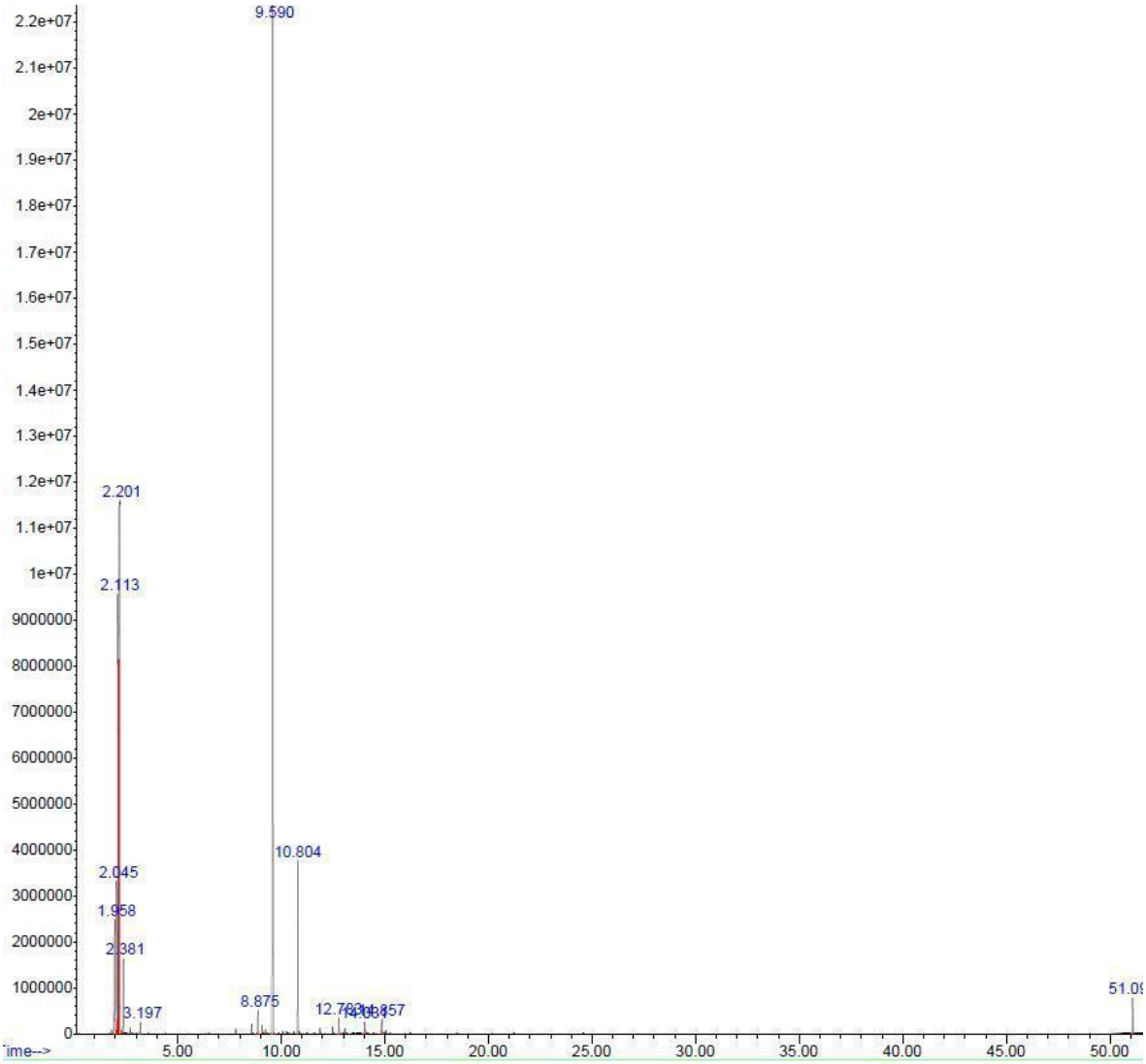


Fig4.4 figure showing analysis of orange peel oil.

4.1.4.1: from the analysis we got the components in orange peels Oils as:

(a)Pentane, 2-methyl

(b)Pentane, 3-methyl

(c) 3.beta.-Myrcene $$ 1,6-Octadiene

(d) l-Limonene $$ Cyclohexene

4.1.5 GC-MS analysis for rose oils:

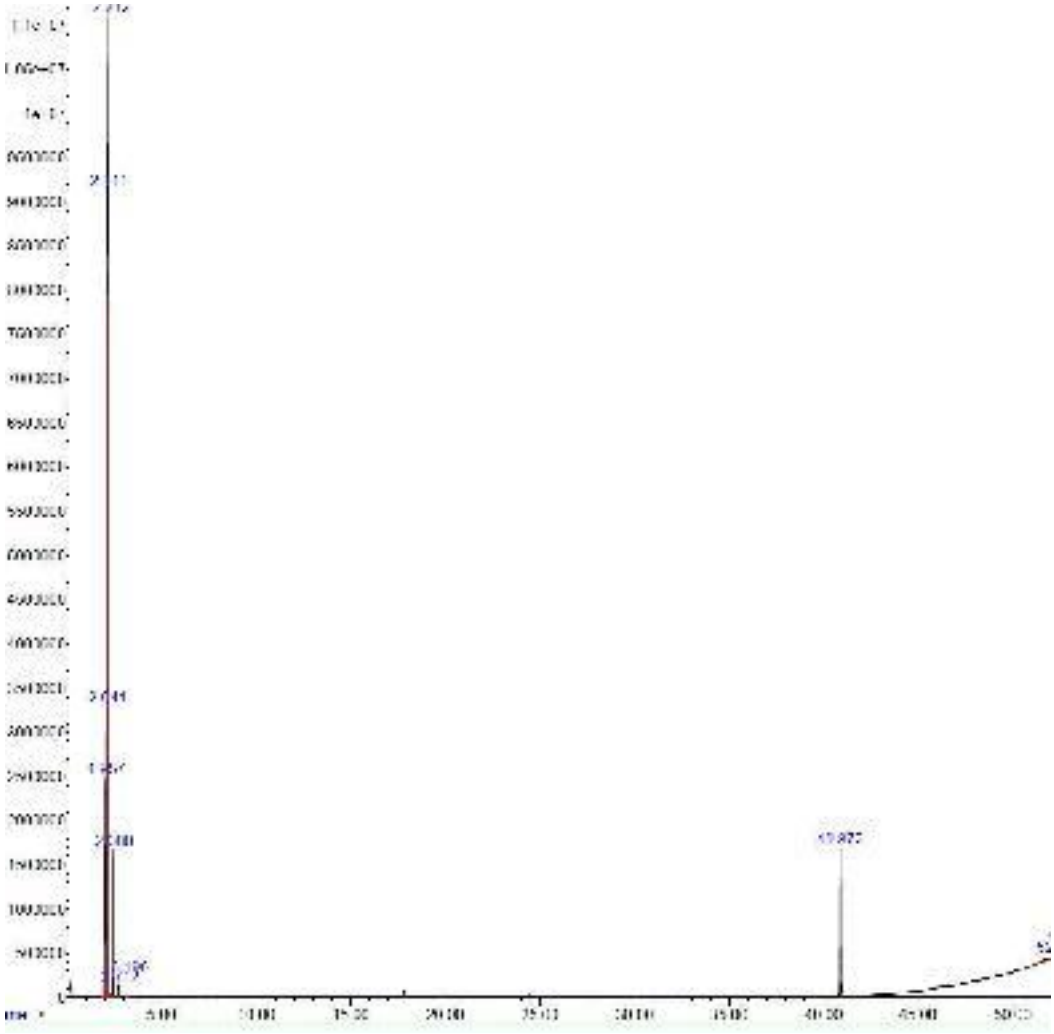


Fig4.5 figure showing analysis of rose oil.

4.1.5.1 :from the analysis we got the components in rose Oils as:

(a) Pentane, 2-methyl

(b) cyclopentane, methyl

(c) Heptane (CAS) $$ n-Heptane

(d) 6,7-Dihydro-5H-benzo[1,2,5]oxaide

4.2 Applications Of The Components Derived From Essential Oils:

4.2.1 curry leaves : The components in essential oil of Indian curry leaf has been examined for its arrangement and is in charge of the fragrance and flavor connected with herbs, flavors, and fragrances and solid antibacterial and antifungal action when tried with microorganisms. The oils from the curry leaves were found to contain basically *oxygenated monoterpenes*. constituents were found with *linalool* . *elemol* . *geranyl acetate* ,*myrcene* .

4.2.2 Hibiscus leaves : The oil was phytotoxic to lettuce and bentgrass and had antifungal activity against *Colletottrichum fraggariae*, *Colletottrichum gloeospporioides*, and *Collettotrichum accuttatum* but exhibited little or no algicedal activities.

4.2.3 Marigold flower: All the marigold oils explored contain elevated amounts of Pentene (more than 50% of aggregate unsaturated fats), making them great for industrial utilization. The compositional contrasts between the genotypes ought to be considered when reproducing and using the pot marigold oil components for nutraceutical and pharmacological purposes.

4.2.4 Orange peels : The antibacterial activity of orange peel essential oils was tried against human pathogenic microorganisms. The outcomes has incredible contrasts in

the activity between citrus species and amid maturing stages. The oils were successful against Gram (+) and Gram (−) microbes, with a real activity against S. aureus and E. coli. Orange peel oil is successful against aeruginosa just at development. Then again, orange peel essential oils removed from juvenile organic product displayed the most noteworthy antibacterial activity against E. coliwhich was equivalent of positive control activity. On account of S. aureus, the oils were generally dynamic at adult stage with orange peel oil demonstrating the most noteworthy antibacterial activity.

4.2.5 Rose flower:

Rose Essential oils are mixtures of regular intensifies that are extricated from plants.Rose oils contain chemical components that the source plant uses to safeguard itself against maladies, parasites and predators.Rose oil can have hostile to bacterial,anti-inflammator properties. Rose oil is by and large utilized as a topical skin inflammation treatment, despite the fact that it might likewise be utilized as a part of fragrant healing applications.Rose oil has a tendency to be ideally equipped for the treatment distinctive dieses and makeup of gentle to direct skin break out manifestations by and large, Rose oil is appraised as a Poor treatment for skin break out. Rose oil is Mostly Ineffective for enhancing pimple inflamation indications and that this solution has a tendency to have Minimal symptoms. The chemicals introduce in rose essential oil are utilized as a part of a mixed bag of skin health. There are claims that both items are helpful for skin tone and for treating sleek skin. There is next to no immediate research or confirmation about the advantages of rose oil for the treatment of pimple inflamation vulgaris. Notwithstanding, a few of the exacerbates that are copious in rose oil, as citronellol and geraniol, have been demonstrated to be genuinely poisonous towards the microbes most in charge of pimple inflammation.

CHAPTER 5

CONCLUSIONS

5.1 At last we can conclude the following factors from the analysis of the extracted oils.

(a) By steam distillation the original qualities of the plant materials will not be harmed during extraction. So it should be a considerable method.

(b) In this method the basic properties of the temperature sensitive materials remain un altered .

(c) If we keep the time constant then the volume extracted can be increased with temperature.

(d)we can keep the temperature constant so that the volume of oils increases with increasing temperature.

(e) If we decrease the pressure then we can get more amount of oils with less interval of time.

(f) Analysis of the oils were done by GC-MS which is a better method for analysis because it contains all the components in the oil with out changing their chemical properties.

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